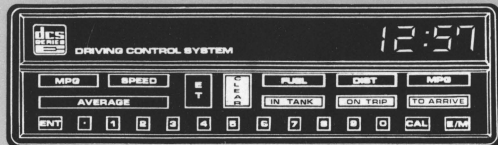


DRIVING CONTROL SYSTEM

- DCS-300 WITH FLOWSENSOR
- DCS-320 WITH FLOWSENSOR
- DCS-310 WITH EFI
- DCS-330 WITH EFI
- DCS-340

OPERATING MANUAL



DRIVING COMPUTER

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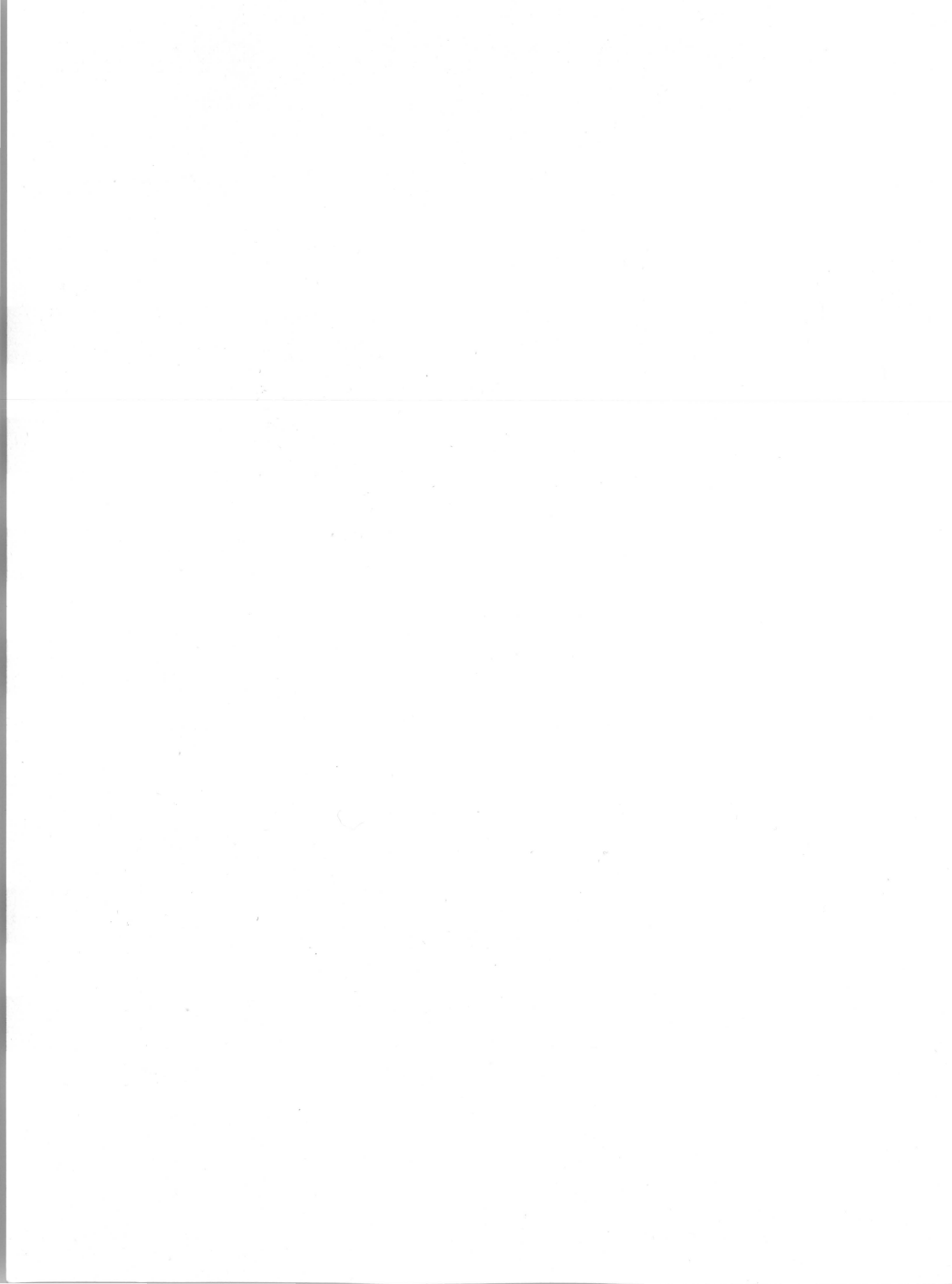
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DRIVING COMPUTER INTRODUCTION

Your Driving Control System (DCS) has been designed to provide you with all the data required to increase your vehicle's efficiency as well as make your driving more pleasurable and productive.

It accomplishes this by monitoring three (3) basic functions:

- 1) FUEL CONSUMPTION—by means of a fuel flow meter.
- 2) DISTANCE MEASUREMENT—by means of magnetic speed pulse devices.
- 3) TIME—by use of a quartz clock and timer.

By combining the inputs from two or more of these monitors, instant, average, historic, current and predictable information is presented at the touch of a button.

For example:

MPG or Miles Per Gallon is the combined function of Distance (traveled) and Fuel (used).

Speed or Miles per Hour is a combined function of Distance (traveled) and Time.

Fuel in Tank—Once you tell the computer (program) what your vehicle tank capacity is (i.e., 20 gallons), you can then get accurate measurements of "FUEL" (remaining) "IN TANK", as well as "FUEL" used.

It can predict:

Because the DCS is programmable, with minimum input from you, it will predict even more valuable information.

For example:

- | | |
|----------------------|---|
| FUEL--To Arrival | = Fuel required to reach your arrival point. |
| DISTANCE--To Arrival | = Distance remaining to your arrival point—continuously as you drive. |
| TIME--To Arrival | = How long it will take to get to your arrival point—at your current speed. |

With this understanding of how the DCS works, the list of functions below will become useful tools, and will help you enjoy driving while accurately monitoring your vehicle's performance.

Here is a tip

At what speed is your vehicle most efficient—45 MPH, 50 MPH, 55 MPH, etc? Chart a course and check fuel consumption (or MPG) at different speeds.

Customize the system to your car!

A few things are required on a one time basis to “program” the DCS to work best in your car.

You must calibrate your CONSUMPTION, DISTANCE and TANK CAPACITY to match your vehicle.

Let’s see how this is done!

METRIC-ENGLISH CONVERSIONS

Your computer will convert fuel, distance, speed and efficiency to either English or Metric units automatically. This allows you to compare the function being displayed in different measurement units. For example, at gas stations selling fuel by the liter.

Pressing **E/M** will alternately display English then metric units. An “E” appears at the left side of the display when in English mode.

MEASUREMENT	ENGLISH	METRIC
Fuel	Gallons(USA)	Liters
Distance*	Miles	Kilometers
Speed	Miles Per Hour	Kilometers Per Hour
MPG	Miles Per Gallon	Liters Per 100 Kilometers(European)

*“E” is not displayed in distance.

IMPORTANT: Before calibrating any function, be sure to verify you are in the appropriate metric/English mode.

SETTING THE CLOCK

Your clock operates on the 12 hour time cycle.

Set the clock by performing the following Key Sequence:

TIME	ENT	hh	.	mm	ENT
		number		number	starts
		repre—		repre—	clock
		senting		senting	
		hours		minutes	

It is 12:04 pm. Set the clock for 12:05. When your time source indicates that the time is exactly 12:05, start the clock by pressing the **ENT** (enter) button again.

PRESS	DISPLAY	COMMENTS
TIME	0:00	
ENT		
1 2	12	These keys are pressed to enter 12 hours.
.	12:	The . enters the colon into the display.
0 5	12:05	
ENT	12:05	Press this key when your time source says that it is 12:05 exactly. If ENT is not pressed, the clock will automatically start after 90 seconds. If no digits are keyed in, zeros are automatically entered.

● CLEARING MISTAKEN ENTRIES

Press **CLEAR** when you make a mistake in entering a number, when you are lost in a key sequence, or in doubt about the status of your driving computer.

The **CLEAR** is also used within special key sequences to clear internal memories.

CUSTOMIZING YOUR COMPUTER

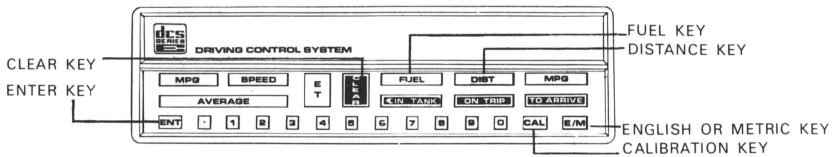
Your driving computer is designed so that, in spite of vehicle variations caused by tire sizes, rear end ratios, tire wear, etc., the readings are nearly 100% accurate through calibrations. In order to "customize" the computer to your vehicle, it is necessary to first calibrate distance and fuel, according to the following steps. Once you have performed these initial adjustments, it is generally not necessary to repeat calibrations, but you may at any time.

1) DISTANCE CALIBRATION

For example, calibrating distance can be done by:

1. Setting distance on the computer to -0-.
2. Driving a known distance; use your odometer or mile markers.

3. Compare the computer reading to the odometer or mile markers.
 4. Change the computer to agree with the odometer or markers.
- Here is the button sequence:



IMPORTANT: Before calibrating, verify the computer is in appropriate English/metric mode. For example, if you intend to calibrate miles, press **SPEED**. If "E" does not appear in left side of display, press **E/M**.

To calibrate distance and speed, it is necessary to travel a known distance (at least 3 miles), using your car's odometer as a guide. Follow these steps:

1. From a dead stop, note and write down the mileage reading on your car's odometer. Make certain that all digits of the reading are centered, as shown below:

WRONG 1 7 8 3 4 7 RIGHT 1 7 8 3 4 0

NOTE: If your vehicle has a trip odometer, simply reset to zero.

2. On your driving computer, PRESS: **DIST ENT 0 ENT**
3. Now drive your car a known distance, at least 3 miles. Bring your vehicle to a stop.
4. On your driving computer, PRESS: **DIST CAL nn CAL**

number of
miles actually driven

EXAMPLE: You wish to calibrate distance and speed. You write down current reading on vehicle's odometer, which is 0 9 5 5 3 0 or set trip to 0 0 0 0.

Now: Zero the distance on your DCS.

PRESS	DISPLAY	COMMENTS
DIST	nn	
ENT		Display blank.
0		
ENT	0.00	This clears the distance register.

After driving 3.0 miles, you bring your vehicle to a stop. Vehicle odometer reads **0 9 5 5 6 0** , or trip reads **0 0 3 0**
Now:

PRESS	DISPLAY	COMMENTS
DIST	3.36	Uncalibrated reading on the computer.
CAL		Display blank.
3 . 0	3.0	You always input actual mileage driven when calibrating.
CAL	3.00	Hereafter, your distance and speed display will be as accurate as the calibration distance.

NOTE: Vehicle odometers are often in error by significant amounts, because legal requirements are not very demanding, and tire sizes, etc. can affect accuracy. The following procedure can be substituted for improved accuracy in calibrating distance and speed.

EXAMPLE: You wish to calibrate distance and speed. Utilizing a federal highway, you pull up alongside a distance marker, and:

PRESS	DISPLAY	COMMENTS
DIST	nn	
ENT		Display blank.
0	0	
ENT	0.00	This clears the distance register.

After driving 3.0 miles you pull up alongside a marker:

DIST	3.36	Uncalibrated reading on the computer.
CAL		Display blank.
3 . 0	3.0	You always input actual mileage driven when calibrating.
CAL	3.00	Hereafter, your distance and speed display will be as accurate as the calibration distance.

2) FUEL CALIBRATION

This calibration is provided to insure that the flowsensor operation matches the climatic conditions (temperature and altitude) where you live as well as the characteristics of your engine.

IMPORTANT: During calibration, be sure that vehicle is level during refueling, the tank is carefully and completely filled, and that the computer is in the appropriate English/metric mode.

To calibrate fuel, it is necessary to consume a known quantity of fuel, using the fuel pump register when you refuel as a guide. Follow these steps:

1. Fill your tank completely. (Top it off)
2. On your driving computer, PRESS: **FUEL** **CLEAR**, to clear register and begin calibration.
3. After driving your car for several days, preferably until near empty, refill the tank completely. Note the exact number of gallons (or liters) added as registered on fuel pump.
4. On your driving computer, PRESS: **FUEL**, and note the reading. If it is different from the fuel pump reading, PRESS: **CAL**, and then input the correct reading, that which is noted on the fuel pump. PRESS: **CAL** again, to set calibration.

5. PRESS: **CLEAR** to clear the tank registers, and begin calibration of the next tank of fuel.

EXAMPLE: You wish to calibrate fuel. You fill your tank completely, and wish to start calibration.

PRESS	DISPLAY	COMMENTS
FUEL	(irrelevant)	
CLEAR	0.00	Calibration will begin.

You now drive the car for several days, then refill you tank. Gas station fuel pump show 15.9 used. Now:

PRESS	DISPLAY	COMMENTS
FUEL	14.10	This is the reading your computer currently shows for fuel used. Now correct the DCS to agree with the gas station pump.
CAL		Display goes blank.
1 5 . 9	15.9	Reading on gas station pump.
CAL	15.90	The computer now reads 15.9, the same as the gas station pump. See NOTE below.
CLEAR	0.00	This clears the fuel (used) registers, since your tank is now full.

NOTE: The DCS has now calculated a calibration factor using $15.90 \div 14.10$ and will continue to use this factor on future measurements. See "Extracting Calibration Factors" Page 8

IMPORTANT: You must enter the calibration before you clear the tank registers. Whenever the flowsensor is recalibrated, tank capacity must be re-entered. See Page 7. INPUT TANK CAPACITY.

NOTE: This procedure may be repeated as often as desired. In certain climatic conditions and driving situations the initial fuel calibration will alter gradually. If you notice a discrepancy over several tanks of fuel, between the reading on your computer and that of the fuel pump, it may be necessary to recalibrate the fuel function.

3) TANK CAPACITY

Now that the DCS fuel measurement is customized to you vehicle, lets tell it how much your tank holds. This will allow you to get fuel in tank readings, etc.

IMPORTANT: Before entering fuel capacity, verify that the computer is in the appropriate English/metric mode. For example, if you intend to input capacity in gallons, press **FUEL** .If "E" does not appear in left side of display, press **E/M**

Determine your fuel tank capacity by consulting your automobile Owner's manual. We suggest you input to the computer one gallon less than actual capacity, in order to provide a reserve. Enter your tank capacity by performing the following key sequence:

FUEL **IN TANK** **CAL** **nn** **CAL**

gas tank
capacity minus 1

EXAMPLE: Your automobile Owner's manual states your fuel capacity is 16 gallons. To set your capacity:

PRESS **DISPLAY** **COMMENTS**

FUEL

IN TANK 0.0 0.0 unless this sequence was done before.

CAL

1 5 15 One gallon less for a reserve.

CAL 15.00 The computer is now permanently programmed at 15 gallons.

4) TO RESET AT FILLUP

For utilization of the "FUEL" "IN TANK" functions, it is necessary to clear the fuel and distance registers each time you refuel. It is recommended that you fill your tank completely each time you refuel. In this way, the computer can accurately report your fuel status.

Fill your vehicle and while stopped at gas station, press **FUEL**, and hold down **CLEAR** until display shows zero (approximately 3 seconds).

This resets both fuel and distance since fillup or last reset.

EXAMPLE: You pull into a service station and fill up the gas tank.

PRESS **DISPLAY** **COMMENTS**

FUEL 14.20 14.20 gallons used since last fillup.

CLEAR (hold) 0.00 Fuel and distance reset completed.

EXTRACTING AND RE-ENTERING CALIBRATION FACTORS

There will be occasional times when service work on your vehicle will require disconnection of the battery. If your backup battery is

not installed, this disconnection will "drop" from the computer memory all stored data, including the distance and fuel calibration factors you have worked hard to establish. Therefore, extract and record the calibration factors as soon as you are satisfied with the readings.

Prior to battery disconnection, it is possible to recall these factors so that they may be recorded and re-entered after battery reconnection.

TO EXTRACT DISTANCE CALIBRATION FACTORS:

Press:

DIST ENT 1 ENT CAL 0 CAL A CAL 1 CAL

Record the calibration factor A that appears in the display in the box provided.

TO RE-ENTER AFTER BATTERY RECONNECTION:

Press:

DIST ENT A ENT CAL 1 CAL

Re-enter the calibration factor A from the step above in the box provided:

TO EXTRACT FUEL CALIBRATION FACTORS:

Press:

FUEL ENT 1 ENT CAL 0 CAL B CAL 1 CAL

Record the calibration factor B that appears in the display in the box provided.

TO RE-ENTER AFTER BATTERY RECONNECTION:

Press:

FUEL ENT B ENT CAL 1 CAL

Re-enter the calibration factor B from the step above in the box provided.

"TO ARRIVE" FUNCTIONS

Here you can get some very convenient information and it may save you time and money.

Enter a planned trip by performing the following Key Sequence.

DIST TO ARRIVE ENT nn ENT

EXAMPLE: You plan to take a 150 mile trip—input trip mileage to the DCS.

PRESS	DISPLAY	COMMENTS
DIST	62.47	Distance traveled since fillup.
TO ARRIVE	00.00	
ENT		Display blank.
1 5 0	150	
ENT	150.00	Distance now set.

During the trip, you may ask the following:

1. How far until I arrive? press **DIST** , **TO ARRIVE**
2. How long until I arrive? press **TIME** , **TO ARRIVE**
3. How much fuel is required? press **FUEL** , **TO ARRIVE**

Along the way you pass a road sign that says your destination is 82 miles. You press **DIST TO ARRIVE** . Display shows 89 miles. What do you do?

PRESS	DISPLAY	COMMENTS
DIST	130.47	Distance traveled since fillup
TO ARRIVE	89.23	89 miles shown—actual is 82.
ENT		Display blank.
8 2	82	
ENT	82.00	New distance is now programmed.

"ON TRIP" FUNCTION

Here is more useful information which can be used for short or extended trips using multiple tanks of gas. The "On Trip" functions are completely independent from the "To Arrive" and "IN TANK" functions. You can retain data in the trip memory for short trips to the store or cross country jaunts.

- **TO RESET TRIP:** To reset trip, perform the following Key Sequence:

DIST ON TRIP

**C
L
E
A
R**

(hold until display shows 0.00)

This resets the distance, time and fuel for the trip.

EXAMPLE: You wish to know how far, how long it takes, and how much fuel is required to drive to work...also, what is average speed and average mpg.

PRESS	DISPLAY	COMMENTS
DIST	65.42	Distance since fillup.
ON TRIP	55.2	Distance on last trip.
C L E A R (hold)	0.00	Starts new trip.
after driving to work.....		
DIST	85.59	Distance since fillup.
ON TRIP	20.17	Distance to work
TIME	7.51	Time of day.
ON TRIP	0.30	30 minutes to drive to work.
FUEL	12.53	Fuel used since fillup.
ON TRIP	1.4	Fuel used on trip.
MPG	0	Current mpg (remember, you're stopped)
ON TRIP	14.4	Average mpg to work.
SPEED	0	Current road speed.
ON TRIP	40.3	Average speed to work.

Here is a useful hint!

Let's say you use your vehicle for business and pleasure and would like to accurately obtain the business use information for tax records. Use the trip mode on your DCS to accumulate all the miles driven and fuel used Monday through Friday each week. Clear the ON TRIP register every Monday morning and record the accumulated information every Friday evening!

VALID OPERATING SEQUENCES

OPERATING SEQUENCES:

TIME

Clock time

TIME

ON TRIP

Elapsed time on trip

TIME

IN TANK

Driving time remaining until fuel is exhausted

**E
T
E
T**

(hold)

Stopwatch elapsed time

Freezes elapsed time display (Lap timer)

DIST

Distance traveled since fillup or reset

DIST

ON TRIP

Distance traveled on trip

DIST

IN TANK

Distance to travel before fuel is exhausted

DIST

TO ARRIVE

Distance remaining to arrival

FUEL

Fuel consumed since fillup or last reset

FUEL

ON TRIP

Fuel consumed on trip

FUEL

IN TANK

Total remaining fuel in tank

FUEL

TO ARRIVE

Fuel required to arrival at current consumption

SPEED

Current vehicle speed

SPEED

AVERAGE

Average vehicle speed for trip

MPG

Current fuel efficiency in miles/gal. or liters/100 km.

MPG

AVERAGE

Average fuel efficiency for trip in miles/gal. or liters/100 km.

E/M

Alternately displays metric and English units.

CLEARING SEQUENCES

FUEL

CLEAR

(hold)

Clears fuel, distance since fillup

ON TRIP

CLEAR

(hold)

Clears fuel, distance, and elapsed time for trip

**E
T**

CLEAR

(hold)

Clears stopwatch elapsed time

IMPORTANT: To clear fuel or trip functions, the **CLEAR** button must be pressed for three seconds.

CRUISE CONTROL OPERATING INSTRUCTIONS

(FOR DCS-300 OPTION)

COMMAND MODULE FEATURES

Before performing the road test, you should familiarize yourself with the controls and their functions.

ON-OFF SWITCH:

Left is "OFF"—Right is "ON". This switch places the Cruise Control into an operational mode (ON), or a coast/disable mode (OFF).

INDICATOR LAMP—This Light (Located next to SET/ACC button) indicates cruise engagement when lit.

SET/ACC:

- 1) Set to current speed—When pushed and released quickly, this will cause the cruise control to engage and to maintain the current vehicle speed provided that:
 - A) ON-OFF switch is in "ON" position
 - B) The current vehicle speed is above the minimum engage speed of 25 to 35 MPH
 - C) The brake pedal is not depressed
- 2) Acceleration and Set—when pushed and held down for more than 1 second, the cruise control will engage and the vehicle will accelerate at a smooth and constant rate. When the button is released, the vehicle will stop accelerating and maintain the present speed.

RES/DEC:

Resume to last set speed—after the cruise control has been engaged once and then disengaged, for any reason, you can resume to your previously set speed by pressing this button, provided that:

- A) The ON-OFF switch is "ON"
- B) The current speed is above the minimum engage speed
- C) The brake pedal is not depressed
- D) The ignition key has not been turned OFF and back ON

TAP UP AND TAP DOWN:

The descriptions for **SET/ACC** and **RES/DEC** only apply before the cruise control is engaged. After the cruise control is engaged, these two keys perform additional functions. Tapping **SET/ACC**

causes the set speed to be bumped up by increments of approximately $\frac{1}{2}$ MPH for each tap, and tapping RES/DEC causes the set speed to be bumped down by this same amount. These two additional functions allow you a degree of control never before available in cruise controls. They allow you to precisely trim your set speed to traffic, speed limits, etc. in a simple, easy-to-use manner. The cruise control has a memory which records the number of taps you have given it and adjusts vehicle speed accordingly. For example, tapping the SET/ACC or RES/DEC button 10 times results in a speed increase or decrease of 5~6 MPH.

CAUTION: Do not use TAP DOWN for major speed reduction. Use BRAKE or OFF to COAST, then reset to slower speed and trim with TAP UP/TAP DOWN as necessary.

OPERATIONAL TESTING

The cruise control offers the unique feature of allowing the user to check for proper system operation while the vehicle is standing still if tach sensing is used. This makes troubleshooting much easier and safer than most other cruise control systems which require driving the vehicle to diagnose the system. For this test, move the speed sensor switch to TACH temporarily. Once the test is complete, move the switch back to the appropriate position. leave the switch in TACH position.

- 1) Turn on your ignition key. The keytops on the command module should be lit. This tells you that the computer is now getting 12 volt power. If it is not lit, refer to troubleshooting section in the installation manual.
- 2) Make sure that the vehicle is in park and that only the parking brake is on. DO NOT depress the brake pedal while performing the following test.
Bring the engine up to a fast idle of approximately 1500-2000 RPM and hold it steady at this level.
- 3) Turn ON-OFF switch to "ON" and press the SET/ACC button. The "ENGAGE" indicator lamp next to the SET/ACC button should now be lit.
- 4) Slowly let up on the accelerator pedal and you should immediately feel the cruise control take over and cause the engine to rev up and down once or twice. The ECS will disengage the cruise control within a few seconds if the engine is revving up too fast.

This is normal since there is no load on your engine while the vehicle is in park. If the engine revs up too high and does not disengage, all you have to do to disengage the unit is:

- A) Depress the brake pedal
- B) Turn "OFF" the ON-OFF switch, or
- C) Turn "OFF" your ignition

You have now determined that the vacuum servo, computer, command module are all functioning.

OPERATIONAL NOTE

The minimum engage speed for the cruise control is approximately 25 to 35 MPH. Below this rpm or speed all inputs to the control keys are ignored (i.e. pushing **SET/ACC** or **RES/DEC** will not change the cruise speed in memory).

The resume speed will remain unchanged in memory until reset with the **SET/ACC** key or until the ignition key is turned off.

If there is no setting in the memory, pressing the **RES/DEC** key will not engage the cruise control (the memory is cleared when you turn off the ignition key).

SAFETY FEATURES

The cruise control can be shut off by any of the following methods:

- A) Depressing the brake pedal
- B) Revving up engine too fast
- C) Sliding the ON/OFF switch to OFF
- D) Decelerating approximately 8 MPH (12km/h) below cruise speed
- E) Turning off the ignition switch

The cruise control will disengage if the brake fuse blows, the brake lights burn out, or any of the connectors become separated. There are numerous safety features designed into the electronics module and throttle actuator to insure that should one or more components fail there is still a way to turn off your cruise control. For safe and economical operation **NEVER** operate this or any cruise control

- *in congested traffic, or
- *on wet or slippery roads.

SAFETY NOTE: Should a situation ever arise where actions A thru D above will not disengage the cruise control you can always turn off the ignition switch. If your vehicle has a steering lock, check to make sure it cannot be activated when the car is in gear.

ROAD TEST AND FINAL ADJUSTMENT

The final adjustment of cruise sensitivity must be made while the vehicle is in motion.

Your cruise control comes pre-adjusted from the factory and, if installed properly, should provide satisfactory performance in most vehicles. To determine whether adjustment is necessary, perform the following road test.

- 1) Slide ON/OFF switch to "ON" position.
- 2) Hold **SET/ACC** key down and slowly accelerate vehicle from 20-35 MPH using the gas pedal. You should feel the cruise control take over at around 25 MPH. The speed that it actually takes over is the minimum engage speed for your vehicle.
- 3) Use the gas pedal to accelerate the vehicle to 50 MPH and maintain a steady speed. Now, press the **SET/ACC** button and SLOWLY release your foot from the gas pedal. The cruise control should engage smoothly and maintain a stable vehicle speed.
 - *If the cruise control loses speed when engaged or is sluggish, then increase the cruise sensitivity adjustment by turning clock wise. ↻
 - *If the cruise control gains speed, acts erratic, or seems too responsive and sensitive, then decrease the sensitivity adjustment by turning counter clockwise. ↻
- 4) If adjustments are necessary, note the factory setting and make small adjustments from this point, until unit functions properly.
- 5) As a final check for sensitivity adjustment and to "fine tune" the cruise control, perform the following test:

On a straight and level road, bring your vehicle up to about 55 MPH and engage the cruise control. After the cruise has stabilized the speed, apply the brakes or turn switch OFF and then ON again, reducing vehicle speed to about 35 MPH. Now

press the **RES/DEC** button and slowly release the accelerator pedal. The cruise control should smoothly take over and bring your vehicle back to 55 MPH.

- 6) To check ECS: Rev up your engine by applying clutch. The ECS should disengage the cruise control. If not, refer to troubleshooting guide in the installation manual.

MEMO:

MEMO:

MEMO:

